



RCA INSTITUTES

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Technical Lesson 46

GENERAL ELECTRIC MODELS H-51 AND H-71 — WESTINGHOUSE MODELS WR-6 AND WR-7

RADIOLA MODELS 82 AND 86 — GRAYBAR MODELS 770 AND 900

INTRODUCTION FOR H-51, WR-6, RADIOLA 82 AND GRAYBAR 770. These instruments employ the same circuits and chassis as the receivers described in Lesson 45 with the exception that they include a tone control.

The assembly wiring is shown in Figure 1. The electrical description of this circuit is given in Lesson 45 and will not be repeated here. The tone control is, however, a new feature and therefore a description of its action seems necessary.

The tone control consists of a 40,000 ohm potentiometer in series with a .025 mfd. fixed condenser. This arrangement is shunted around a choke placed in the second detector plate circuit. With the resistor arm at the extreme "high" position, the reactor is shorted and the full amount of the resistance is placed in series with the condenser, thus giving the normal fidelity of the receiver. As the potentiometer arm is moved toward the extreme "low" position, the choke and condenser both become effective, and thus reduce the high frequency output of the receiver. The amount of this reduction is dependent on the position of the potentiometer arm, operated by the tone control knob. Figure 2 shows the correct connections for attaching a magnetic pick-up.

Electrical Specifications

Voltage Rating	105-125 Volts
Frequency Rating	50-60 Cycles, or 25-40 Cycles
Power Consumption	60 Cycles-120 Watts; 25 Cycles-125 Watts
Recommended Antenna Length	25-75 Feet
Type of Circuit	A-C Screen-Grid Super-Heterodyne
Type and Number of Tubes	4 UY-224, 2 UY-227, 2 UX-245, 1 UX-280
Number of Radio-Frequency Stages	1
Type of First Detector	Tuned Input Grid Bias
Number of Intermediate Stages	2
Type of Second Detector	Power Grid Bias
Type of Tone Control	Variable resistance in series with condenser across output of second detector
Number of Audio Stages	1 (Push-Pull)
Type of Rectifier	Full Wave, UX-280
Type of Loudspeaker	Dynamic
Wattage Dissipation in L.S. Field	10 (110 V., 85 M.A.)
Undistorted Output	3.0 Watts

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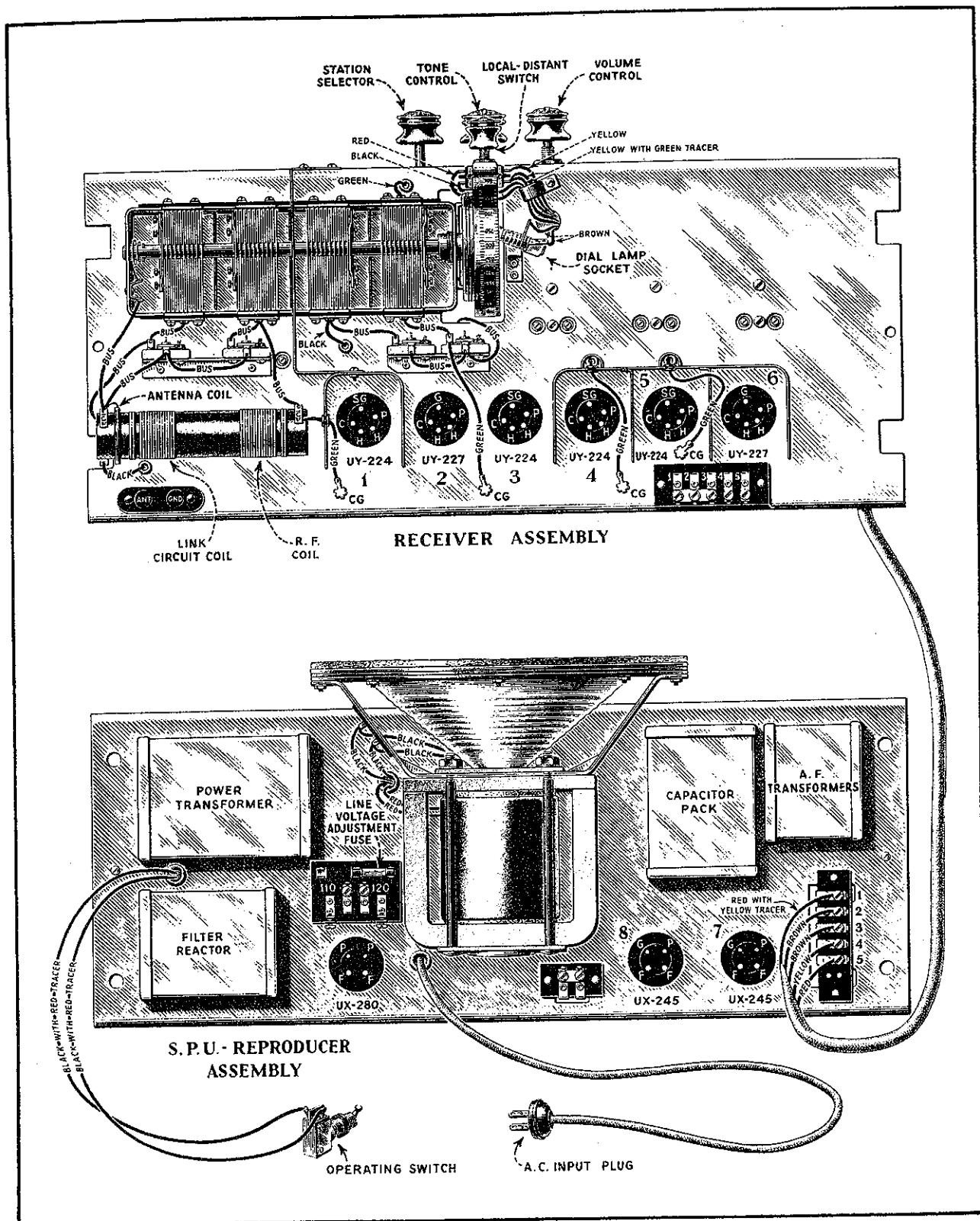


Figure 1

INSTALLATION. The student is referred to Lesson 45 for the following data on installation:

Antenna (Outdoor type).
Antenna (Indoor type).
Special antenna installation
for noisy locations.
Ground.
Tubes.

Location.
Adjustment for line voltages.
Jerky action of station selector.
Use of local-distant switch.
Precautions for excessively loud signals.
Removal of shipping blocks and screws.

BLOWN FUSE. A blown fuse may be caused by the following:

1. Connecting the set to a d-c line
2. Plate to plate short of the 280 tube.
3. Shorted condenser in capacitor pack.
4. Shorted filament or heater contacts or dial lamp socket.
5. Defective power transformer.

Any of the above causes must be cleared up before a new fuse is installed; otherwise the new fuse will blow as soon as the old one is replaced and the power turned "On."

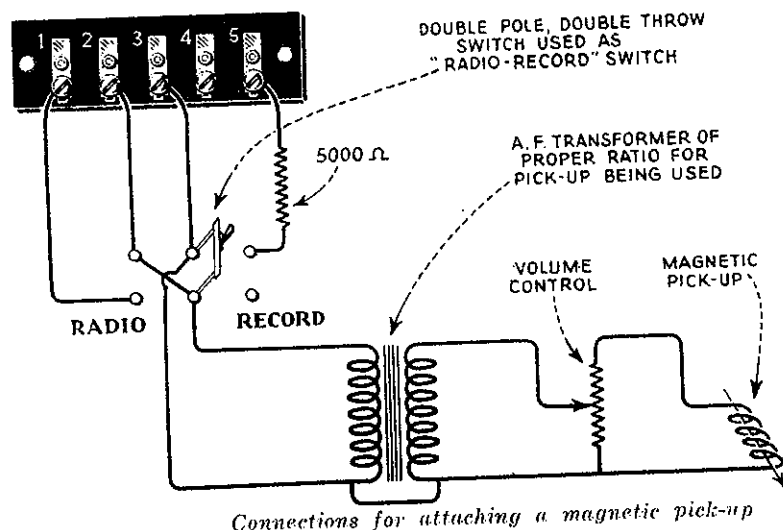


Figure 2

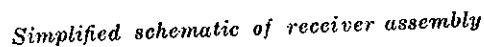
SERVICE DATA ON RECEIVER. The receiver assembly and S.P.U. are very similar in both mechanical and electrical characteristics to that described in Lesson 45. For service information on these units other than that contained herein the student is referred to Lesson 45. This includes:

Antenna system failures.
Tube sockets and prongs.
Noisy volume control.
Broken condenser drive cord.
Excessive hum.
Acoustic howl.
Low volume.

Distorted reproduction.
Audio howl.
Oscillation.
Adjustment of r-f line-up and oscillator
trimming condensers.
Adjustment of i-f tuning condensers.
Line-up adjustments of gang condensers.
Dial scale reading incorrectly.

Figure 3 shows the schematic circuit diagram. Figure 4 shows the simplified schematic circuit of the receiver assembly. Figures 5 and 6 show the wiring diagrams of the receiver assembly and S.P.U., respectively.

To remove receiver assembly.
To remove S.P.U. reproducer assembly.
Replacing reproducer cone.



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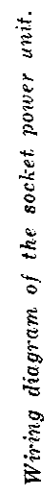


Figure 6

SERVICE DATA CHART

Before using the following Service Data Chart, when experiencing no reception, low volume, poor quality, noisy or intermittent reception, howling and fading, first look for defective tubes, or a poor antenna system. If imperfect operation is not due to these causes the "Service Data Chart" should be consulted for further detailed causes.

Indication	Cause	Remedy
No Reception	No current at outlet Defective operating switch Blown fuse Defective parts in S. P. U. Defective parts in receiver assembly Open field coil of reproducer Open cone coil of reproducer	Turn line current "On" Repair or replace operating switch Repair cause of blown fuse and replace Test and repair any defective parts Test and repair any defective parts Repair or replace open field coil Replace defective cone
Low Volume	Low voltages from S. P. U. Defective socket power unit Defective receiver assembly Poor antenna system I. F. transformers not properly aligned R. F. trimmers not properly aligned Shorted field coil of reproducer unit	Repair any cause of low voltage Repair or replace any defective part in S. P. U. Repair or replace any defect in receiver assembly Install antenna system as suggested on instruction card Align I. F. transformers correctly. Align R. F. trimming condensers correctly Repair any defect in reproducer
Poor Quality	Receiver not properly tuned Local-Distant switch not operated properly Defective A. F. transformer Defective tone control parts Receiver improperly aligned Defective or grounded 60,000-ohm resistor in S. P. U.	Tune receiver correctly when receiving stations Be sure to use "Local" when receiving nearby strong stations Replace defective transformer Replace defective tone control parts Align receiver correctly Replace defective resistor or repair ground
Howling	Shipping blocks not removed Defective rubber cushions Radiotrons	Remove shipping blocks from receiver assembly Replace any aged or hardened rubber cushions Check Radiotrons used in detector and push-pull sockets
Hum	Defective Radiotron UX-280 Defective part in S. P. U. Grounded heater lead Defective field coil	Replace defective Radiotron Replace defective part Repair any ground in heater leads Repair or replace field coil
Dial reads incorrectly	Dial screen not in position Dial lamp bracket bent Set not properly aligned Oscillator used for aligning not calibrated correctly	Readjust dial screen at low frequency end of scale Bend dial lamp bracket back to normal Align set correctly Calibrate oscillator accurately

Electrical Specifications

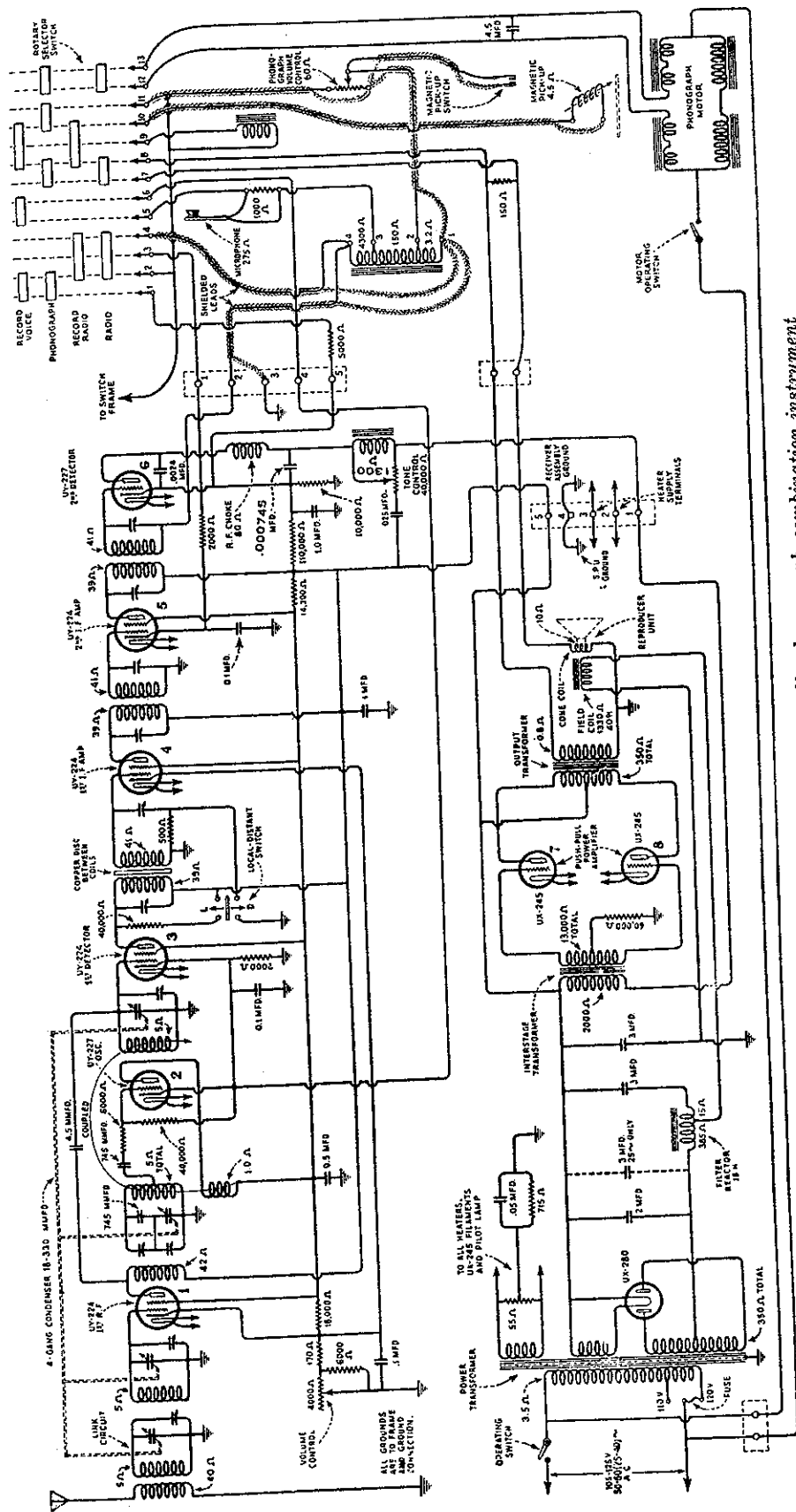
Voltage Rating	105-125 Volts
Frequency Rating	50-60 Cycles; or 25-30 Cycles
Power Consumption (Radio Alone).....	60 Cycles-120 Watts; 25 Cycles-125 Watts
Power Consumption (Phonograph).....	60 Cycles-155 Watts; 25 Cycles-200 Watts
Type of Circuit	A-C Screen-Grid Super-Heterodyne
Type and Number of Tubes	4 UY-224, 2 UY-227, 2 UX-245, 1 UX-280
Number of Radio-Frequency Stages	1
Type of First Detector	Tuned Input Grid Bias
Number of Intermediate Stages	2
Type of Second Detector	Power Grid Bias
Type of Tone Control	Variable resistance in series with condenser across output of second detector
Number of Audio Stages (Radio)	1 (Push-Pull)
Number of Audio Stages (Phonograph or Recording)	2
Type of Magnetic Pick-up	Low Impedance
Type of Tone Arm	Inertia
Diameter of Turntable	12 Inches
Type of Rectifier	Full Wave, UX-280
Type of Loudspeaker	Electro-Dynamic
Wattage Dissipation in L.S. Field	10 (110 V., 85 M.A.)
Undistorted Output	3.0 Watts

ELECTRICAL DESCRIPTION OF CIRCUITS. These instruments are combination radio receivers similar to those described in the first part of this lesson, an electric phonograph employing an improved type of magnetic pick-up and tone arm and a home recording mechanism by which either a radio program or sound production in the home may be recorded on home recording record blanks.

These sets incorporate the tone control of those just described and when the rotary switch is in the "Radio" position, it is electrically the same. The schematic circuit is shown in Figure 7. Its operation in the other positions follows:

PHONOGRAPH. When the rotary selector switch is in the "Phonograph" position, the radio portion of the receiver is made inoperative and the second detector is used as an audio stage together with the power amplifier. The magnetic pick-up is suspended by the new "inertia" type tone arm. This name originates from the method of weighting and then counter-balancing so as to have sufficient weight and mass present for best reproduction. This weight prevents the tone arm and pick-up from vibrating with the record variations and provides true reproduction, due to the needle following exactly the record variations. The phonograph parts are shown in Figure 10.

The output of the pick-up is fed into an auto-transformer which in turn applies this voltage to the grid of the second detector. The grid bias of this tube has been changed in order to have it operate as an audio amplifier. The output of this tube is then applied to the two UX-245's, acting as a power amplifier, the output of which is in turn delivered to the reproducer unit. The volume of output is controlled by a 60 ohm potentiometer connected across the magnetic pick-up.



Schematic circuit diagram of the radio-phonograph combination instrument

Figure 7

RADIO RECORDING. Any radio program may be recorded on a home recording blank with this instrument. The additional material required is a record blank and a special home recording needle.

The electrical functions of recording a radio program are the same as that of receiving such a program with the exception that the pick-up is substituted for the cone coil of the reproducer unit. The cone coil is then connected across the output with a 150 ohm series resistor in the circuit and the reproducer is used as a monitor. When acting as a cutter greater pressure is required on the record than when reproduction is in progress. Therefore a small weight is provided for placing on the pick-up head while recording.

After making a record, it may be played either on the present instrument or any other phonograph in the usual manner with the exception that the special needle used for recording must also be used for reproducing. If the present instrument is used, it is important that the weight on the pick-up head be removed, otherwise the record will be damaged.

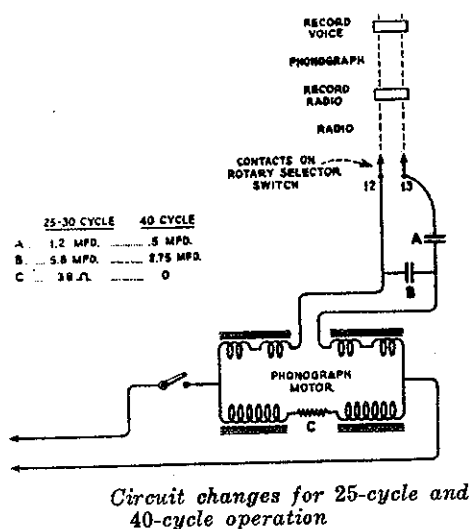


Figure 8

HOME RECORDING. A small hand microphone is provided for recording the voice or other programs originating in the home. This microphone is connected in series with the bias resistor of the first detector and across a tap on the pick-up input transformer. About 10 milliamperes then flows through the microphone. The circuits then function as in "Phonograph Reproduction" except that the output of the 245 tube is fed into the pick-up instead of the reproducer unit. The weight must be used on the pick-up as in radio recording.

The operation of the audio circuits with selector in its various positions is shown in Figure 9.

Models are also available for 25-30 cycle operation and these may be adapted to 40-cycle operation by means of a special motor condenser. The differences between the 25-cycle and the 60-cycle models are: The power transformer; the additional filter capacitor; the rotary switch; and the motor condenser. These parts are shown in Figures 7 and 8.

SCHEMATIC AUDIO CIRCUIT DIAGRAMS

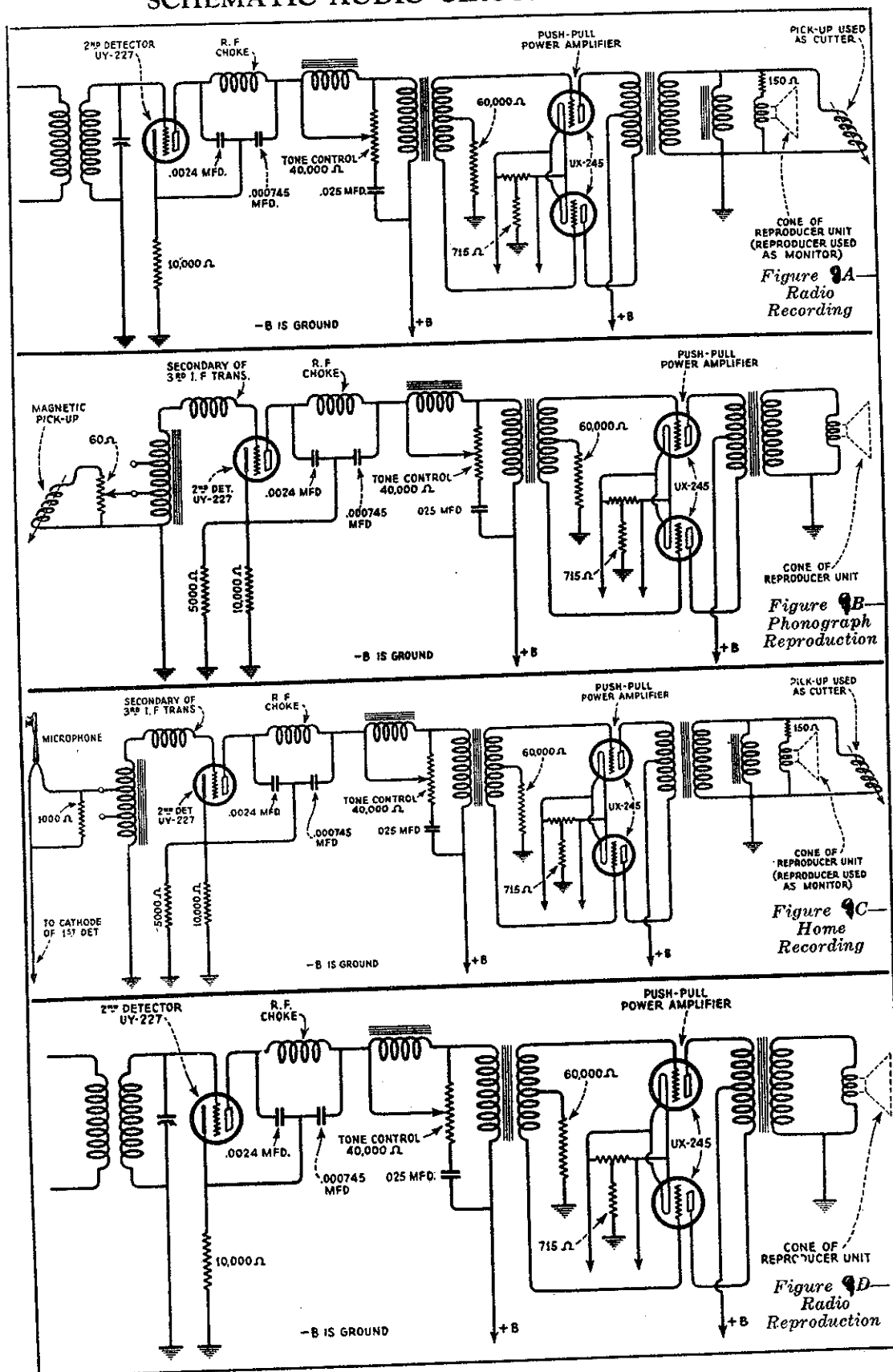


Figure 9

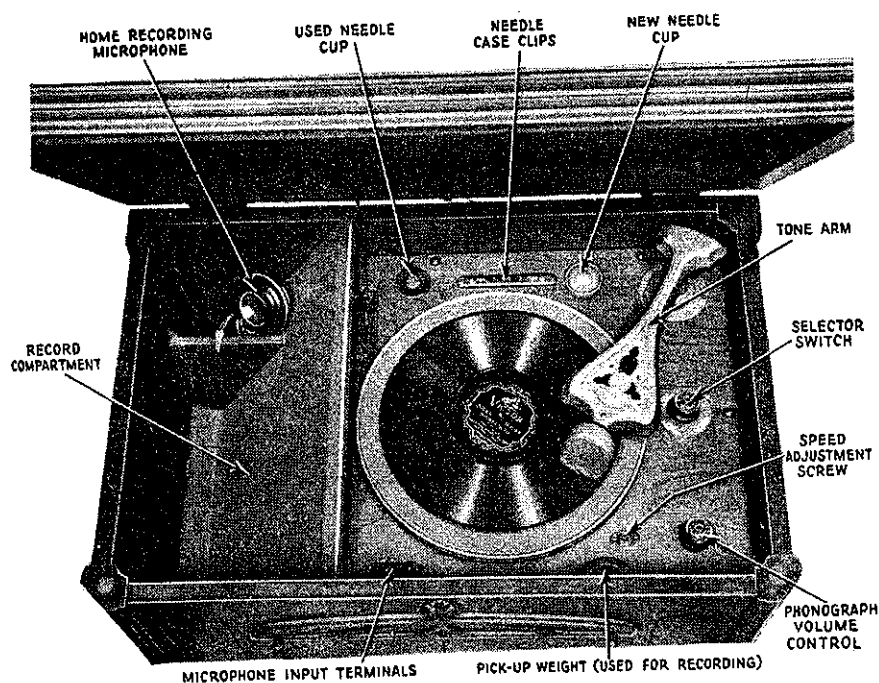
INSTALLATION. The student is referred to Lesson 45 for the following data on installation:

Antenna (Outdoor type).
Antenna (Indoor type).
Special antenna installations
for noisy locations.
Ground.
Tubes.

Location.
Adjustment for line voltages.
Jerky action of station selector.
Use of local-distant switch.
Precautions for excessively loud signals.
Removal of shipping blocks and screws.

BLOWN FUSE. A blown fuse may be caused by the following:

1. Connecting the set to a d-c line.
2. Plate to plate short of the 280 tube.
3. Shorted condenser in capacitor pack.
4. Shorted filament or heater contacts or dial lamp socket.
5. Defective power transformer.



View of phonograph parts

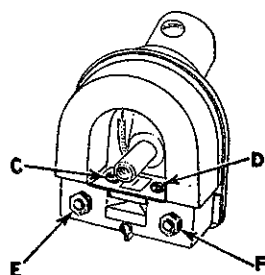
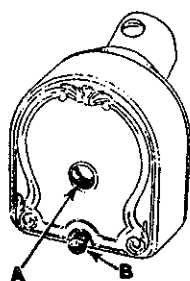
Figure 10

Any of the above causes must be cleared up before a new fuse is installed; otherwise the new fuse will blow as soon as the old one is replaced and the power turned "On."

ADJUSTMENT OF LID MECHANISM. A spring mechanism is provided that balances the lid at any opening position. Failure of proper operation is indicated by the lid either continuing to open or close after the hand is removed. If this condition is present adjust as follows:

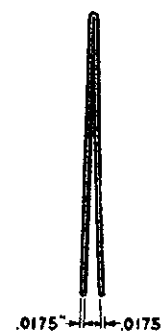
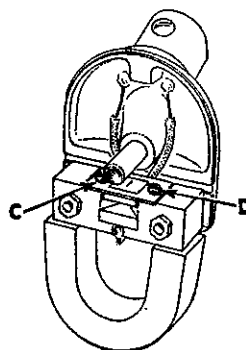
1. If the lid continues to open after being released, too much tension is present on the spring. Reduce the tension by turning the adjusting screw counter-clockwise gradually until normal operation is secured.
2. If the lid closes upon release of the hand insufficient tension exists at the spring. Increase the tension gradually by turning the adjusting screw clockwise until normal operation is secured.

If the spring has lost its tension it must be replaced. If a replacement spring is not available try removing a turn from the old spring.



Disassembling the magnetic pick-up

Figure 11



Magnetic pick-up armature spacing tool

Figure 12

SERVICE DATA ON RECEIVER. The receiver assembly and S.P.U. of this receiver is very similar in both mechanical and electrical characteristics to those described in Lesson 45. For service information on these units other than that contained herein the student is referred to Lesson 45. This includes:

Antenna system failure.
Tube sockets and prongs.
Noisy volume control.
Broken condenser drive cord.
Excessive hum.
Acoustic howl.
Low volume.

Distorted reproduction.
Audio howl.
Oscillation.
Adjustment of r-f line-up and oscillator trimming condensers.
Adjustment of i-f tuning condensers.
Line-up adjustments of gang condenser.
Dial scale reading incorrectly.

ELECTRICAL TESTS. The electrical tests given in Lesson 45 are all applicable to the present instrument when the rotary switch is in the "radio reproduction" position. There is one slight difference to remember, however, and that is the 1300 ohm choke and .000745 mfd. condenser in the plate circuit of the second detector in the present instrument that is not in the receivers described in Lesson 45.

SERVICE DATA ON MAGNETIC PICK-UP. Service work on the magnetic pick-up may be divided into the following classes:

1. Adjustment of the armature.
2. Replacing rubber pivot supports and damping block.
3. Replacing coil.
4. Replacing armature.

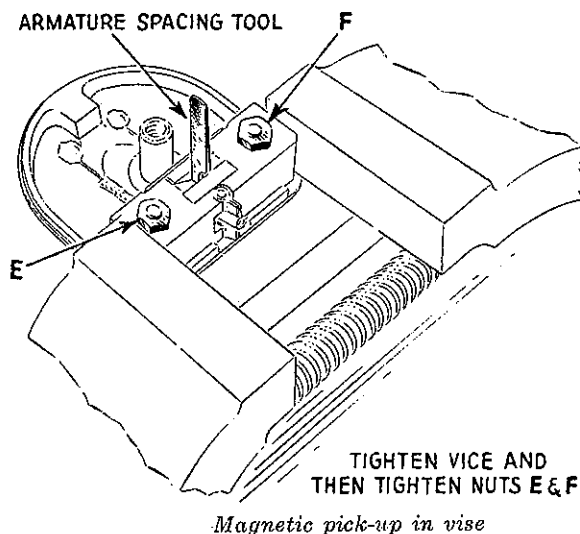
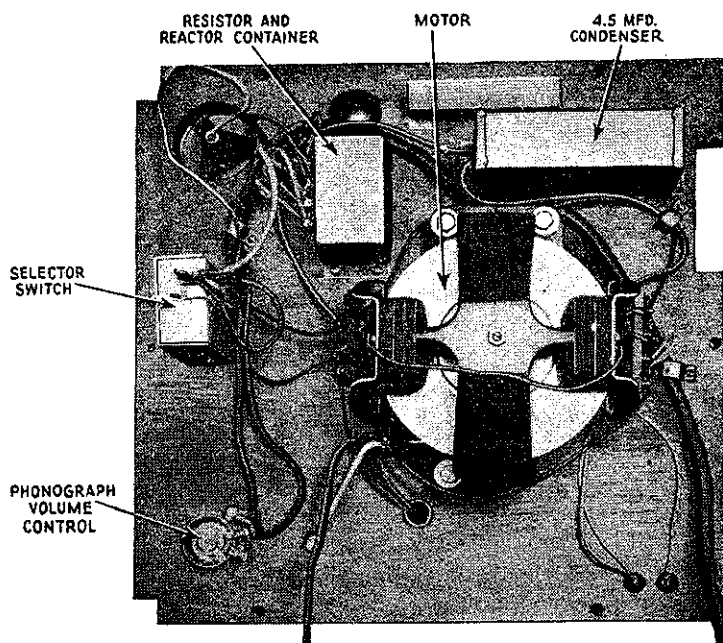


Figure 13



Bottom view of the phonograph motor mounting board, showing various parts.

Figure 14

ADJUSTMENT OF ARMATURE. Adjustment of the armature consists essentially of having it in its electrical center between the two pole pieces. Need for this adjustment is usually evidenced by distortion during phonograph reproduction with blasting, especially on the low notes. The following procedure should be adopted when making this adjustment:

1. Remove screws A and B (see Figure 11) from the pick-up, and remove the cover thereby released.
2. Mark the magnet poles and the pole pieces so that when they are replaced they will be in their original position. The magnet may now be released. Place a keeper such as a large nail across the magnet poles and remove the magnet from the pole pieces. Another way is to slide the magnet over the pole pieces until it is on the opposite side of the armature adjusting screws. (See Figure 11.)

If the magnet is released from the pole pieces or keeper even for an instant the efficiency of the pick-up as a record cutter is seriously impaired. Be careful not to let this happen and if it does, remagnetize the magnet before and after reassembling.

3. With a small screw driver loosen screws C and D. The small piece of metal that holds the damping block may now be moved either way until the armature is approximately between the two pole pieces. Judging the center by the eye is sufficiently accurate for this adjustment.
4. After the center has been located the two screws, C and D, should be tightened. The magnet may now be replaced, the keeper removed and the pick-up reassembled in the reverse manner of that used to remove it. While reassembling be sure that all dirt is completely removed from any part of the magnet, armature or other parts of the pick-up.

REPLACING RUBBER PIVOT SUPPORTS AND DAMPING BLOCK. After considerable time, or due to climatic conditions, the rubber pivot supports and the rubber damping block may become hardened and require replacement. Such hardening is usually evidenced by the armature being set to one side and not moving easily. As with other rubber articles, these parts give best life when used frequently.

The pick-up should not be supported, when not in use, by the needle resting on the record or turntable as such use will tend to set the armature to one side. The pick-up should hang free.

Usually the rubber pivot supports and damping block will require replacement at the same time, and are therefore supplied in sets of three. When a replacement is necessary such a set should be procured. If such a set is not available and a repair is urgently needed, the damping block may be cut from a piece of automobile inner tube. The rubber strips for the pivot support may be cut from the thin portion of a baby's rubber nipple. Use the following procedure when making replacements:

1. Procure magnetic pick-up armature spacing tool. This is listed in the manufacturer's spare parts catalog, or it may be easily constructed by referring to Figure 12.
2. Remove the pick-up case and the magnet from the pole pieces.
3. Unsolder the leads to the coil at the terminal strip inside of the pick-up case. Remove nuts E and F, Figure 11, and release the pole pieces from the back support. Now remove screws C and D and disassemble the pole pieces, armature and coil. The old rubber should be completely removed from all parts, and the parts should be scraped clean with a knife.
4. Place the new rubber pivot supports in their proper place. This may either be tubing or strips. Reassemble the pole pieces and coil, and new rubber damping block in place with armature spacing tool in place as shown in Figure 13. Now place in a small vise and clamp the pole pieces together, as shown in Figure 13, with the spacing tool in place. Tighten nuts E and F, remove pick-up from vise and remove spacing tool.
5. Reassemble the magnet and cover, making sure the small magnet clamp is in place at the top of the magnet.

REPLACING PICK-UP COIL. The pick-up coil may be replaced in the same manner as the rubber supports and damping blocks, the difference being that the coil is replaced instead of the rubber pieces.

REPLACING PICK-UP ARMATURE. The pick-up armature may be replaced in the same manner as the rubber supports or coil, the difference being that the armature is the part replaced. All adjustments are the same. In some cases replacement of the armature is made necessary due to rust. If a new armature is not available, the old one may be temporarily repaired by removing all rust with sandpaper. This is not a permanent repair due to the fact that the sandpapered surface will quickly rust, so therefore a new armature should be installed as soon as available.

TESTING MAGNETIC PICK-UP AND TONE ARM. After a magnetic pick-up has been repaired it is good practice to test it on actual records. The following Victor records are very desirable for test purposes. For testing the ability of the pick-up and tone arm to track the record groove use:

"Funeral March of a Marionette" - No. 6639. "Zampa" - No. 35985.

For a voice as well as low frequency test at the same time:
"A Gay Caballero" - No. 21735.

For dance music which has an evidence of high frequency as well as low frequency response use: "Bull Fiddle Blues" - No. 2155.

For checking low frequencies mainly use: "Aloha Oe" - No. 21121, which at the very end has about 50 cycles recorded on it, also "Andantino" - No. 35843.

For testing rattle of pick-ups: "My Carolina Sunshine Girl" - No. 40096.

PHONOGRAPH MOTOR SERVICE DATA. The phonograph motor used is of the induction disc type and is unusually rugged in construction. (See Figure 14.) The following covers the details of any service that may become necessary.

LUBRICATION OF MOTOR. The various bearings and gears of the motor should be kept clean and should be lubricated at least once every six months. Phonograph motor oil and motor grease should be used and applied to the points indicated in Figure 15. Should phonograph motor oil and grease not be available, any high grade light engine oil may be substituted for the oil and vaseline for the grease. Before lubricating it is desirable that the parts first be cleaned with carbon tetra-chloride, (Carbena), and all dirt and old grease removed. In addition to the regular lubrication all bright metallic parts, except the motor disc, should be covered with a light film of oil to prevent rusting.

SPEED REGULATION. A stroboscope disc is included with each instrument which makes speed adjustments very easy. The instructions for its use are printed on each disc and will not be repeated here. If a stroboscope disc is not available the method on sheet 19 may be used for correct speed adjustments.

1. Place a record on the turntable and insert a small piece of paper under the edge of the record to serve as an indicator.

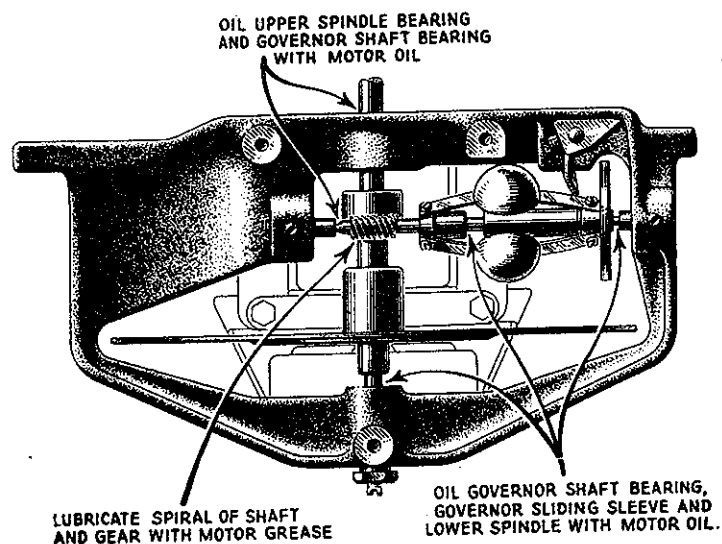
MAGNETIC PICK-UP SERVICE DATA CHART

Indication	Cause	Remedy
No reproduction	Poor volume control contact between arm and resistance	Clean volume control resistance with a pipe cleaner and any of the various cigarette lighter fluids
	Open pick-up coil or connections	Repair any loose connections by resoldering or replace an open coil
Weak or distorted reproduction	Loose needle	Tighten needle in socket with needle set screw
	Dirty contact in volume control	Clean volume control resistance and contact arm
	Armature out of adjustment	Center armature as described
	Defective rubber damping block or pivot supports	Replace rubber damping block and pivot supports
	Dirt in armature air gap	Clean all dirt from air gap by means of a blower or disassemble pick-up and clean. Remove rust from armature if necessary
	Weak magnet	Remagnetize magnet by taking to magnet repair shop. Place keeper across pole faces until magnet is again in place in the pick-up. Making repairs without placing a keeper on the magnet is the easiest way of having the magnet lose its magnetism.
	Needle holder rattle	If the needle hole of the pick-up cover touches the set screw that holds the needle, a rattle will result.

2. Play the record in the normal manner and count the number of revolutions made by the turntable for one minute. The speed should be 78 revolutions per minute.
3. Turning the speed regulating screw (Figure 10) clockwise allows the motor to run faster, and counter-clockwise, slower. Adjust by trial until the speed is 78 revolutions per minute as determined from a full minute's count.

NOTE: The speed of the machine should be checked at least four or five times a year. Improper speed will cause distortion.

GOVERNOR. The governor will maintain a constant speed of the motor within a range of sudden voltage changes of 20 volts, providing all the parts are correctly adjusted. Any adjustment made on the motor (including lubrication) will have a certain effect on the regulation of speed and the speed adjustment should be checked before the unit is again placed in service.



Lubrication points of the phonograph motor

Figure 15

NOISY OPERATION.

1. **Governor Springs.** A noise or rattle may sometimes be caused by loose or broken governor springs. Tighten all the governor spring screws. If this does not stop the noise, loosen the screws on the gear end of the governor springs and allow the motor to run for a minute or two to allow the springs to assume their correct position. Stop the motor and retighten the screws. If any of the springs are broken or badly out of balance, they should be replaced.
2. **Governor Bearings.** The thrust bearing at the gear end of the governor may cause noise while the motor is running. Hold one finger over the end of the bearing and loosen the set screw which holds the bearing in position. Adjust the bearing to the most quiet running position and retighten the set screw. If this procedure is not successful the position of the governor spiral

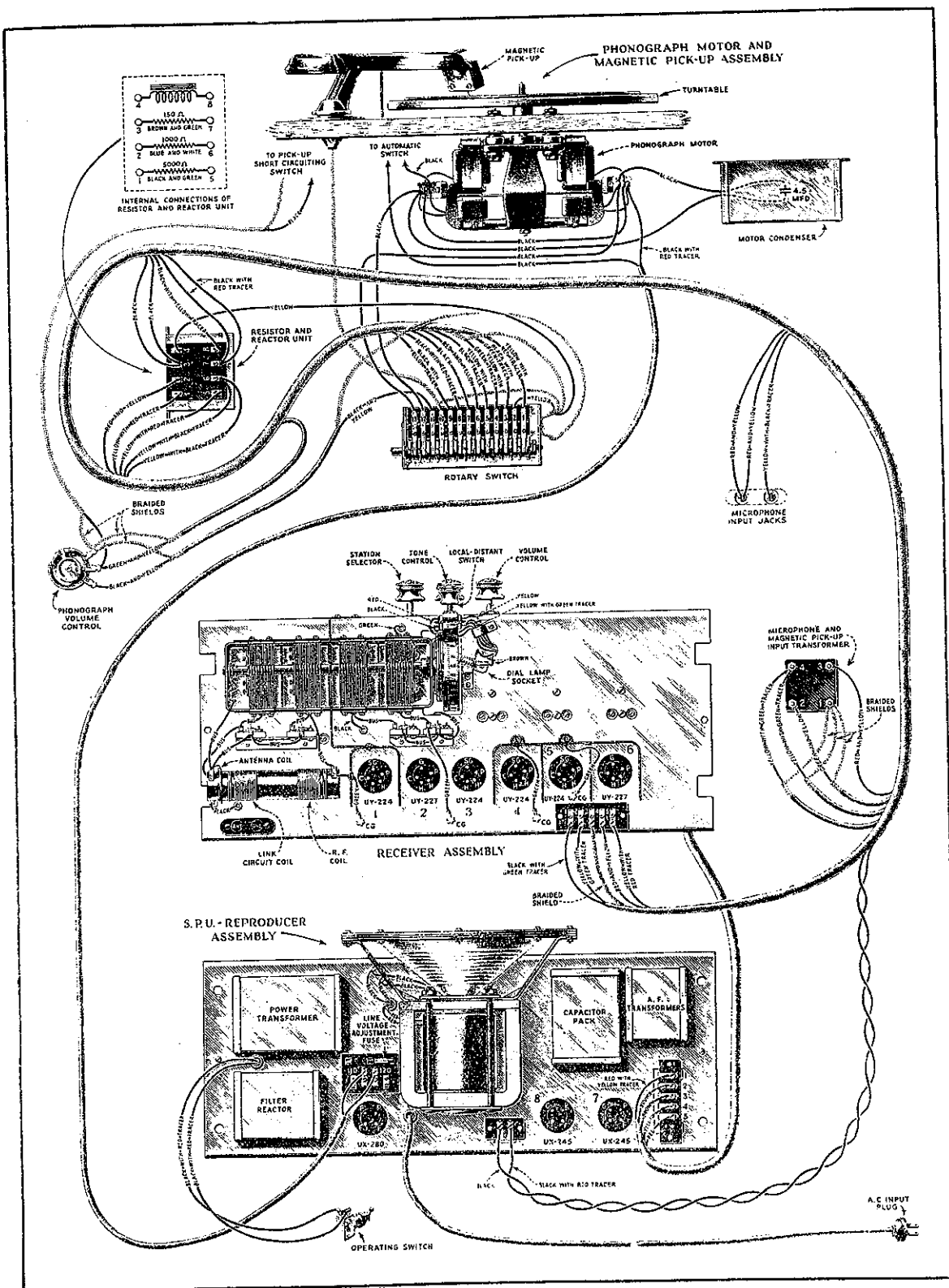
relative to that of the governor drive gear should be shifted slightly until a condition of minimum spiral to gear noise is obtained.

To do this the set screw holding the thrust bearing at the gear end of the governor spindle is loosened and the bearing shifted slightly and reclamped (loosening the bearing on the opposite end of the shaft first if necessary). Now, with the bearing at the disc end of the spindle loosened and one finger against it to prevent it from slipping out, start the motor. While the motor is running, press lightly against this bearing and clamp the set screw to hold it in place. The center of the worm should be approximately opposite the center of the worm gear. If this is not the case for the position of minimum noise a defective or poorly lubricated worm or worm gear is indicated. A bent governor spindle may also be the cause.

3. Governor Spindle. A bent governor spindle will cause binding in the gears and bearings as well as noise. The bent spindle should be replaced with a new one. Removal of the governor can be accomplished by loosening the two governor bearing screws, one at each end of the governor shaft, and lifting the governor from the frame.
4. Governor Driving Gear. Remove the motor spindle and examine the gear for wear. If the wear on the teeth is uneven on opposite sides of the gear the turntable spindle is bent and both gear and spindle should be replaced.
5. Turntable Spindle and Disc. A bent turntable spindle, or a bent or improperly adjusted disc will cause noise. The bent spindle may cause the disc to rub against the iron core of one of the coils. A bent spindle can be detected by placing a pencil flat on the motor board with the point against the spindle; if the pencil point touches the spindle on one side only while the motor is running, the spindle is bent and should be replaced. If the disc is bent and rubs against the cores of the motor coils the lower spindle bearing should be adjusted, or the disc should be replaced, depending upon the extent of the damage.
6. If the motor "bumps" (turntable jumps up and down), it may be due to a faulty or worn gear or worm; insufficient grease or poor grease on the worms; or not enough turns on one of the upper motor coils.

HEATING. Normal operation of the motor will produce more heat than can comfortably be tolerated while touching any of the coil units. This is mentioned in order that the service man will not misconstrue this heating as an indication of a defect.

CONTINUITY OF MOTOR CIRCUITS. Due to the absence of a motor terminal board it is best to disconnect the motor and test for continuity of circuit directly at the motor coils. This may be done by any of the methods used for regular continuity tests. Associated circuits should be checked by referring to the diagram, Figure 16.



Assembly wiring diagram of the radio-phonograph combination instrument

Figure 16

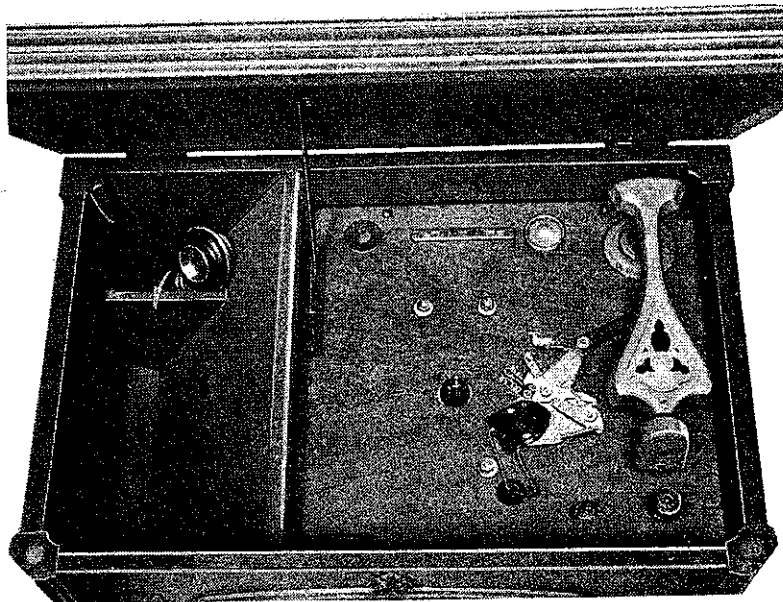
PHONOGRAPH MOTOR SERVICE DATA CHART

The following Service Data Chart indicates the cause and remedy for any difficulties which may be encountered in the operation of the phonograph motor. These are listed according to their indications:

Indication	Cause	Remedy
Failure to run	Operating switch or record switch "off" or defective	Turn switches "On" or repair any defective switches
	No A.C. power at socket outlet	Check with a 0-150-V. A.C. voltmeter
	Loose or open connection in the connector cord or plug	Repair any defective connections
	Wrong or open connections of motor coils	Check wiring and make any repairs necessary
	Jammed motor	Rotate turntable by hand with power on. If jammed examine motor and replace or repair part causing jamming
	Shipping wedges not removed	Remove paper wedges if used between disc and coils to hold motor during shipment
Motor fails to maintain correct speed	Low line voltage	Check line voltage with a 0-150 Volt A.C. voltmeter while motor is running and phonograph is in operation. The voltage must be between 105-125 for proper operation.
	Improper lubrication	Examine moving parts, bearings and gears. If oil and grease is gummy clean and lubricate
	Motor improperly mounted or jarred in shipping	Loosen the three motor mounting screws and tighten alternately while motor is running. Do not tighten any screw sufficiently to cause binding or slowing down of the motor
	Worn motor spindle ball bearing	Replace a worn ball bearing
	Weak motor coils	After checking all the above causes and the motor still fails to maintain speed replace one or both of the motor coils It is possible for them to test electrically O. K. but be weak in operation
Hum	Loose coils or coil laminations	Tighten screws that hold coil cores together. If this does not correct the hum place a small wooden wedge between inside of coil and core
	Cabinet hum	Tighten motor mounting screws or replace the rubber between motor and cabinet

TO REMOVE MOTOR. If it is necessary to remove the phonograph motor, it may be done in the following manner:

1. Place the pick-up and tone arm to the side, clear of the turntable. Remove needle from pick-up and remove turntable.
2. Gain access to the rear and remove all wiring to the motor.
3. Remove the three nuts, washers and rubber pieces from the motor supporting bolts, being sure to hold the motor so that it will not drop. It may now be moved to a place convenient for work.



View of motor board with turntable removed

Figure 17

REPLACING THE MOTOR COILS. Should the necessity arise for replacing the coils of the induction disc phonograph motor proceed as follows:

1. Remove the motor as outlined in the foregoing paragraph.
2. Open the lugs holding the black power leads to the motor frame and remove these leads to one side.
3. Release the round head machine screws holding the coil unit, which is to be replaced, to the motor frame.
4. Put the new coil unit in place and replace the coil unit mounting screws, tightening them carefully.
5. Replace the black power leads under the lugs and reconnect the power leads to the proper points on the terminal board as shown in Figure 16. Lubricate motor if necessary.
6. Replace motor and turntable and test for operation and speed.

REPLACING THE MOTOR GOVERNOR PARTS. If it is necessary to remove the governor, to replace the governor spindle or springs use the following procedure:

1. Remove the motor.
2. Unscrew governor bearing screw.
3. Push the governor spindle against this bearing so as to start it out of its socket, and remove this bearing.
4. Remove the governor spindle with its associated parts.
5. All governor parts are now readily accessible and it may be disassembled. The governor spring holding collar is fastened to the governor spindle by means of a small set screw, and the spindle is "spotted" to facilitate proper replacement.
6. Replace the governor spindle and its assembled parts by placing the outer tip of the spindle in the outer thrust bearing socket first, and then inserting the inner tip into its bearing, after which the outer bearing is replaced, and its set screw tightened, being careful to leave a little play in the bearings.
7. It is usually a good plan to lubricate the unit whenever service work is done.
8. Replace motor and turntable, and test for operation and speed.

REPLACING THE MOTOR SPINDLE, DISC OR GOVERNOR DRIVING GEAR.

1. Remove motor from cabinet.
2. Open the lugs holding the power leads to the motor frame and move these leads to one side.
3. Remove the three mounting screws from the coil unit on the opposite side of the motor from the governor, and remove this coil unit.
4. Press down on the speed regulating arm so as to release the pressure on the governor friction disc, and turn the motor disc so that the set screws in the hub of the motor disc and the governor driving gear are readily accessible.
5. Loosen both set screws far enough to back them out of the recesses provided for them in the motor spindle and draw out the spindle.
6. The motor should now be reassembled in the reverse of the above procedure, making any necessary replacements.

NOTE: Care should be taken to see that the ball bearing under the lower end of the motor spindle is not lost.

7. After assembling the motor the lock nuts around the spindle adjusting screw should be loosened and the spindle adjusting screw should be adjusted until the motor disc turns freely in the center of the air gap of the coil units.
8. Tighten the spindle adjusting screw lock nut.
9. Replace the motor and turntable.
10. Lubricate the motor.
11. Reconnect, following the wiring diagram, Figure 16, and test for operation and speed.

REPLACING THE MOTOR SPINDLE BALL BEARING. A worn motor spindle ball bearing will cause slow or varying speed and should be replaced as follows:

1. Place the pick-up and tone arm clear of turntable, remove any needle which may be in the pick-up and remove the turntable.
2. Loosen the spindle adjusting screw lock nut and remove the motor spindle adjusting screw. The ball bearing may now be removed.
3. Place the unit in its normal operating position. The motor disc will now rest on the pole faces of the lower or current coil.
4. Lay a card across the motor mounting panel, against the motor spindle, and mark the spindle lightly at the point of contact.
5. Lift the spindle until the motor disc touches the pole faces of the upper or voltage coils and again mark the spindle.
6. Put the new ball bearing in place and replace the motor spindle adjusting screw, adjusting it so that the card placed across the motor board will make contact against the spindle just half-way between the two marks previously made. This should place the motor disc in the center of the air gaps. If the disc is warped an additional adjustment one way or the other may be necessary to prevent it from rubbing against the pole pieces in operation.
7. Lubricate, replace turntable and test for operation and speed.

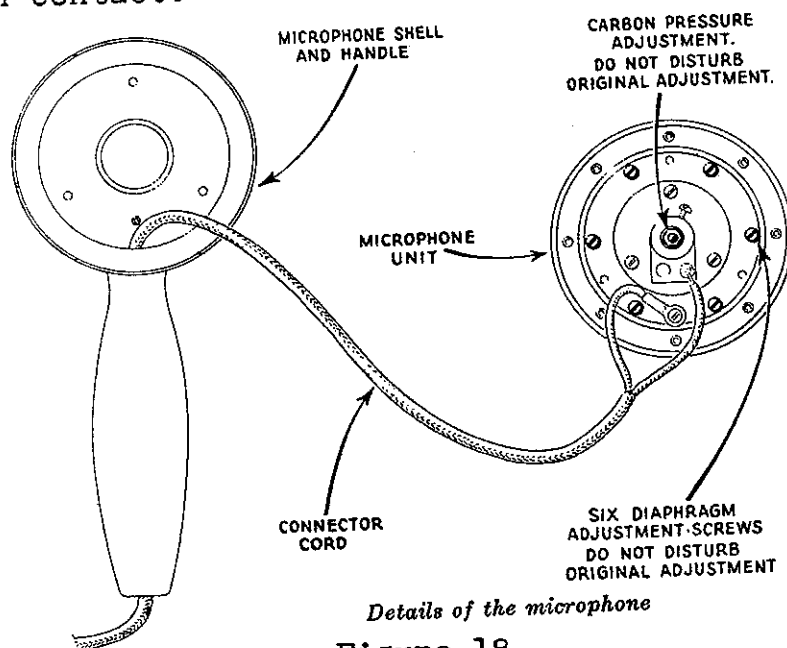
SERVICE DATA ON MICROPHONE. The small hand microphone used for home recording is of rugged construction and will give good service.

If any difficulties be encountered, however, repairs other than replacement of the cord, the handle and shell, or the mechanism should not be attempted. The adjustment of the diaphragm and carbon pressure is made at the factory and is practically impossible to duplicate in the field. Figure 18 shows the essential elements of the microphone which may be replaced.

SERVICE DATA ON AUTOMATIC SWITCH MECHANISM. A special mechanism is provided which at the end of a Victor eccentric groove record, opens the power to the motor and short circuits the magnetic pick-up. The absence of a brake eliminates any mechanical noise that might be present while the turntable is being stopped and the shorting of the pick-up prevents any needle scratch from being reproduced. The effect is that at the end of a record a slight click is heard and then silence until the next record is played.

PICK-UP SWITCH FAILURE. Should the motor stop at the end of a record, but the pick-up switch fail to work, resulting in a record scratch while the turntable is stopping, it may be due to any of the following causes:

1. Poor connections at pick-up switch. Check and repair connections if necessary.
2. Contact arm bent or its tension lost so that contacts do not close. Repair or replace if necessary.
3. Adjustment of contact in relation to arm not properly made. Loosen the screws that hold the switch to the base plate and shift entire switch until the latch arm properly engages the switch contact.

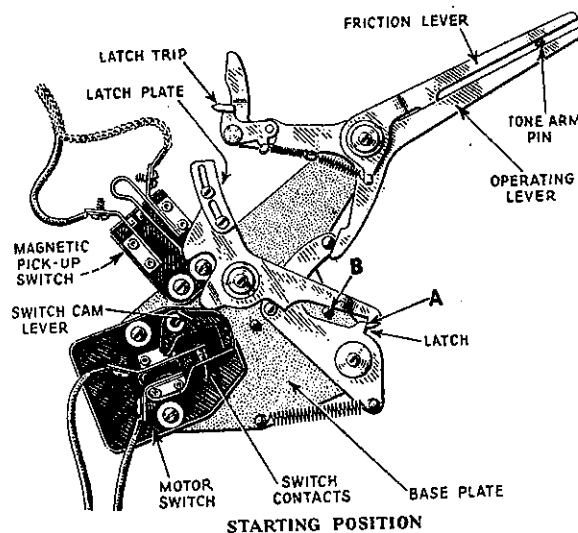


Details of the microphone
Figure 18

MOTOR SWITCH FAILURE. If the motor fails to start when the tone arm is pulled to the right, the switch should be examined to see that it is operating properly. See Figure 19.

The left-hand screw holding the switch to the base plate passes through an oversized round hole in the switch body and the right-hand screw passes through an elongated hole in the switch body. This permits of a considerable adjustment of the switch on the base plate.

1. Remove the single small screw holding the switch cover in place.
2. Set the tone arm to the "On" position and examine the switch contacts to see that they close.
3. If the switch does not close and the switch cam lever may be moved away from the switch contact, leaving a gap between the contacts, the movable contact spring should be bent so as to increase its tension and cause the contacts to close.
4. If the switch cam lever does not have a sufficiently free movement to permit the contacts to close, both switch mounting screws should be loosened, and the switch should be adjusted on the base plate (with the tone arm in the "On" position), so that there is a space of $1/32$ in. between the switch cam lever and the latch cam, and about $1/16$ in. between the switch cam lever and the spring anchor pin. When this adjustment has been made tighten the switch mounting screws.
5. Clean the switch contacts with 00 sandpaper to remove any corrosion that may be present.
6. Replace the switch cover plate.
7. Replace the turntable with the tone arm in the "On" position so as to clear the brake lever arm of the inside rim of the turntable, and rotate the table by hand to permit the slot in the turntable to slip over the pin in the motor spindle.



Automatic switch mechanism

Figure 19

AUTOMATIC SWITCH MECHANISM SERVICE DATA CHART

Indication	Cause	Remedy
Failure to trip	Loose latch plate	Tighten latch plate screws with plate in correct position. (See Fig. 19)
	Latch trip does not engage latch plate properly	Increase tension on latch trip
	Defective latch plate. If the friction lever swings with the eccentric record groove, but the operating lever fails to swing or swings slightly, the latch trip is probably caught in a burr on one of the teeth of the latch plate	Remove all burrs from the latch plate with a piece of emery cloth or a fine file. Also make sure no burrs are on the edge of the latch trip
Premature tripping	Worn surface	Examine the contact surfaces between the brake lever and the latch (point "A," Figure 19). These two surfaces must be square. If they have become worn round, they should be squared with a fine file
	Insufficient tension	If the latch does not strike the latch stop pin "B" (Figure 19), when the brake lever is pulled to the "On" position, increase the tension of the latch spring

EXAMINATION - LESSON 46

1. If the phonograph motor bumps up and down what is likely to be the trouble?
2. How is the speed of the phonograph motor regulated?
3. What will happen if a WR-7 receiver is connected to a d-c line?
4. If distortion or blasting occurs when a record is being played what is likely to be the trouble?
5. Why is it necessary to place a "keeper" across the pole pieces of the magnetic pick-up when it is disassembled?
6. How would you eliminate humming caused by the phonograph motor?
7. If no reproduction could be obtained from the phonograph what would likely be the trouble?
8. If the power transformer in a Radiola 86 should become defective with the receiver in operation what would happen?
9. If the volume should become too low what steps would you take to remedy this fault?
10. What would you do if the volume control operated noisily?